**Site 200 Gloucester Water Pollution and Control Facility**

***Overview:*** The Gloucester Water Pollution and Control Facility (WPCF) potential restoration site is located along the western side of Eastern Route 133 (Essex Avenue) approximately 0.25 mi north of the Route 127 intersection. There are two remaining tidal wetland areas to the north and south of fill placed near the center of the former marsh to construct the Gloucester WPCF. Both remaining wetland areas are connected to Blynman Canal (Annisquam River) via long 36 in RCP culverts which join before crossing under Route 133. The site encompasses approximately 22 ac of salt marsh, *Phragmites*–dominated marsh, and forested wetland upstream of Route 133. The area has been significantly altered by past land uses. Essex Avenue appears to be shown as a causeway over two large tidal creeks extending west of the road on 1893 USGS mapping (Gloucester, MA Quadrangle USGS 15 Minute Series). The 1944 USGS mapping (Gloucester, MA Quadrangle, USGS 7.5 Minute Series) appears to show a small bridge crossing over the northern tidal creek (in the current location of Cape Ann Marina) and roadway fill over the southern creek. An excavated channel running parallel to the upstream edge of Essex Road is shown providing a connection between the two creek systems. City tax mapping based on photography taken in 1957 shows an extension of a local road from the west crossing the southern creek and salt marsh in the approximate location of the southern limits of the WPCF.

The 1980's USGS map shows the previous northern connection to the Canal eliminated by fill placed in the location of Cape Ann Marina and two closely spaced culverts further south. One in close vicinity to the existing culvert under Route 133 and one approximately 225 ft further to the south. The mapping also shows much of the salt marsh fill in place for the construction of the WPCF. The date of the current configuration is likely associated with the construction of the wastewater facility.

The poor configuration and small size of the existing culverts causes a substantial restriction in tidal exchange to both the northern and southern portion of the remaining tidal wetlands. Tide gauge data collected in late April of 2005 documented a maximum restriction of approximately 3.6 ft. Other evidence of a tidal restriction includes: impounded conditions upstream of the crossing, populations of invasive species including *Phragmites,* and subsidence of the marsh plain.

The entire southern portion of the restoration area, along with the wastewater facility is municipally-owned. The majority of the northern restoration area, with the exception of the extreme southern fringe bordering the wastewater facility, is in private ownership.

***Structure conditions:*** Tidal flow is currently conveyed under Route 133 from the Blynman Canal (Annisquam River) via a 36 in cast iron culvert. Flow is then split into two 36 in RCP culverts. One culvert discharges into the salt marsh south of the facility. The other culvert runs parallel to Route 133 and discharges into the salt marsh north of the facility. The two 36 in RCP culverts that discharge into the upstream salt marshes are in good condition. They were apparently constructed around 1985 at the same time as the WPCF. The 36 in CIP inlet is in fair condition. The life expectancy of the 36 in RCP culverts is greater than 25 years. Based on a limited visual inspection of the culvert outlets, the life expectancy of the 36" CIP culvert is approximately 10-15 years. The condition of these culverts should be further accessed (video survey) during a Feasibility Study.

***Ecological Integrity:*** The potential restoration site generally has a low level of ecological integrity. The fill placed for the construction of the wastewater facility resulted in the filling of approximately 10 ac of salt marsh. Other encroachments into the wetland have occurred from

commercial development along Route 133 as well as residential homes along the southern border off Route 127 and Kent Circle. The severe restriction in tidal exchange has resulted in substantial wetland cover type changes. Much of the salt marsh depicted on historical mapping is currently emergent wetlands dominated by either *Phragmites* or *Typha*. Both scrub-shrub and forested wetlands have also expanded onto the former salt marsh plain north of the WPCF. There are a number of small trees within the southern restoration area which were killed by an increase in water levels some years ago. This was likely related to past ditch cutting and OMWM conducted by the Mosquito Management District. A comparison of biological benchmarks between the unrestricted marsh and the potential restoration areas indicates the marsh areas upstream of Route 133 have experienced a subsidence of approximately 0.8 to 1.2 ft.

The southern portion of the restoration area also appears to suffer from increased nutrient loading as evidenced by an increased growth of algae in comparison to the northern site. Past elevated levels of fecal coliform within the wetland have been traced to failing septic systems to the west of the site. However most are expected to be tied into a recently constructed private sewer extension project (Dave Sargent, City of Gloucester, pers. comm.). There is a freshwater stream which flows into the northern restoration area. Runoff into both restoration areas is expected to increase with the expansion of residential development within the steeply sloping uplands to the west. The impounding of freshwater lowers salinity levels which benefits the expansion of invasive species.

The southern restoration area is owned by the City, although access to the area is not encouraged. The roadway is owned by the City as well. The site is not contained within an ACEC, or mapped as listed species habitat. The remaining wetlands are mapped as BioMap core habitat. The adjacent intertidal areas of the Annisquam River are mapped as suitable habitat for soft-shelled clam. The significantly elevated invert above the downstream creek bed restricts upstream fish passage over the lower portion of the flood tide. Fish passage is also impacted by the configuration and excessive length of the culverts.

Gauges were deployed from April 21 to May 2, 2005 within the northern and southern restoration areas as well as downstream of the culvert under Route 133. Results of the deployment show that there are significant restrictions to tidal flow through the culverts in both restoration areas and that these restrictions occurred during all of the 21 tidal cycles recorded by the tide gauges. Slightly greater restrictions were observed within the northern restoration area. Stone placed in front of the inlet into the northern culvert also causes water levels to remain substantially elevated in comparison the southern site during ebb tide conditions. The highest tide downstream of the WPCF was recorded on April 28 at 2:46 AM. The NAVD adjusted height was 6.76 ft. The corresponding high tide in the upstream marsh creek to the north of the WPCF occurred at 5:04 AM at an adjusted height of 3.17 ft. The restriction caused a tidal dampening of 3.59 ft. and a delay of 2 hrs 18 min. The dampening amounted to approximately 32.8% of the total tidal prism recorded at the downstream gauge.

High tide in the upstream creek south of the WPCF occurred at 4:46 AM at an adjusted height of 3.53 ft. This restriction caused a tidal dampening of 3.23 ft. and a delay of 2 hrs. The dampening amounted to approximately 29.5% of the total tidal prism recorded at the downstream gauge. Both the northern and southern areas did not impound more water during substantial precipitation events which occurred on the 24$^{th}$ and 28$^{th}$. Measured salinities were 22.2 ppt. at the downstream gauge, 24.5 ppt at the north site and 9.3 ppt at the south site during an early flood cycle.

The overall severity of the existing impairments is considered severe. Larger structures placed lower in elevation would reduce the tidal restriction and substantially benefit both impaired marsh

systems. The excavation of perimeter ditching would enhance the control of *Phragmites.* Depending on the amount of increased tidal exchange, restoration efforts could cause substantial die-back of bordering scrub-shrub and forested wetland as well as the conversation of a T*ypha*-dominated wetland within the upper reaches of the northern restoration area. There are a series of relatively low-lying residences along the southern edge of Route 127 and Kent Circle. There is an abandoned sewer line running along the back of these properties. They are currently connected to a new sewer line running down the street in front of the homes. In general these properties appear to be approximately 4.0 ft above the elevation of the adjacent marsh. There are several low-lying structures in poor condition near the eastern fringe of the northern restoration area. More detailed survey of these structures is necessary to refine restoration options. The removal of existing fill along Route 133 south of the wastewater facility was not considered as future expansion to include secondary treatment will likely require all of the remaining undeveloped lands.

***Socioeconomic:*** Recreational values of the potential restoration site are reduced by the limited access, parking and proximity to the WPCF. Educational opportunities are enhanced by the municipal ownership within the southern portion and the nearby High School. The site's Uniqueness/Heritage value is impacted by the severity of the existing impairments, however the wetlands are mapped as BioMap core habitat and provide urban setting values.

***Construction Logistics/Feasibility:*** The constructability and construction costs for restoration at this site are dependant on the restoration design. One option which would provide the most benefit to the southern restoration area involves the construction of a new culvert under Route 133 extending from the location of the existing culvert inlet into the restoration area and connecting directly to the channel north of Route 133. The existing culvert would serve as a bypass to maintain flows during construction and would then be blocked so all the tidal flow from the 36 in CIP pipe under Route 133 is directed to the northern restoration area. The marsh would benefit from additional OMWM practices and possibility perimeter ditching. This work would help reduce the expansion of *Phragmites* and improve tidal exchange throughout the marsh.

Providing a second open channel or culvert along the back of the WPCF was considered to allow increased flow within the southern area to flow into the northern area. There is currently approximately 20 ft between the property line and the recently constructed biofilter system to improve odor control at the facility. This narrow distance would not allow for an open channel, although a long culvert would be possible. Several factors limit the practicality of this additional culvert. It would require substantial excavation within the wetlands to provide a hydraulic connection in a location that did not previously support one. It is also likely – given lag time in the tidal prism – that a very large culvert would be required to ultimately pass a relatively small volume of water. Hydrologic modeling would be required to verify these assumptions. The modeling would also determine the benefits of directing the entire capacity of the existing pipe under Route 133 into the northern restoration area.

Given the high traffic volumes and importance of Route 133 as an evacuation route, it is unlikely that a road closure would be allowed, thus increasing project costs. The possibility of utilizing Bond Street to the west should be further explored. Work within the Route 133 right-of-way is complicated by the presence of major below and above ground utilities. These include a major sewer interceptor and discharge from the facility. The locations and inverts of those utilities (which would be difficult to relocate) may influence the available pipe sizes and configurations for restoration, and require further investigation.

The constructability for the option of installing a new culvert under Route 133 south of the current location is considered medium. The culvert for this option could be jacked under Route

133 instead of standard open trench construction. Pipe jacking would not disrupt traffic on Route 133, and therefore might be a more appealing option to the City. However, pipe jacking it is typically much more expensive when compared to standard open trench construction and is only used as a last resort. This construction alternative should be investigated during a feasibility study to determine its impacts and costs when compared to standard open trench construction. Construction costs associated with this option are estimated to be $650,000.

After thoroughly assessing the benefits that could be derived from directing all the capacity of the existing 36 in pipe under Route 133 to the northern restoration area, the replacement of this culvert could be considered as well. However, this option would double the costs of the project. Conceptually, this option consists of replacing the existing 36 in CIP pipe under Route 133 and 36 in RCP culverts with larger box culverts in their current locations. After these culverts cross Route 133, angled sections would direct each culvert to both restoration areas. Construction costs associated with this option are estimated to be $1,400,000.

***Restoration Potential:*** The site is considered to have moderate restoration potential based on the area of restoration available, the severely impacted ecological integrity of the wetlands, the partial municipal ownership and proximity to the High School for education purposes. The site's potential is reduced by the high costs associated with the major infrastructure improvements. The construction work is complicated by the number and size of utilities under the road and the control of traffic. The road was recently reconstructed as part of a major sewer line construction. The fact that there are several potential restoration options available (none of which would restore conditions that existed prior to the construction of Route 133), adds to the complexity of the restoration variables. Future actions leading toward project implementation should focus on more detailed elevation information of the adjacent low-lying abutters, video inspection of existing culverts, detailed utility investigations, hydrologic modeling of possible alternatives to refine cost estimates, coordination with the City and MassHighway regarding traffic control, and gauging the level of interest among municipal officials, abutters, and other owners of the marsh. The future expansion of the treatment plant to provide secondary treatment may also require mitigation which could involve portions of the work described above or possibility involve the strategic removal of historic wetland fill from some locations.

Site # 200 | Site Features | Scale: 1:3,000

**Photo 1 - Downstream View of Culvert**

**Photo 2 - Scour Pool and Marsh Downstream of Crossing**

**Photo 3 - Salt Panne within Southern Site**

**Photo 4 - Salt Marsh within Southern Site Upstream of Culvert**

**Photo 5 - Upstream View of Culvert In Southern Site**

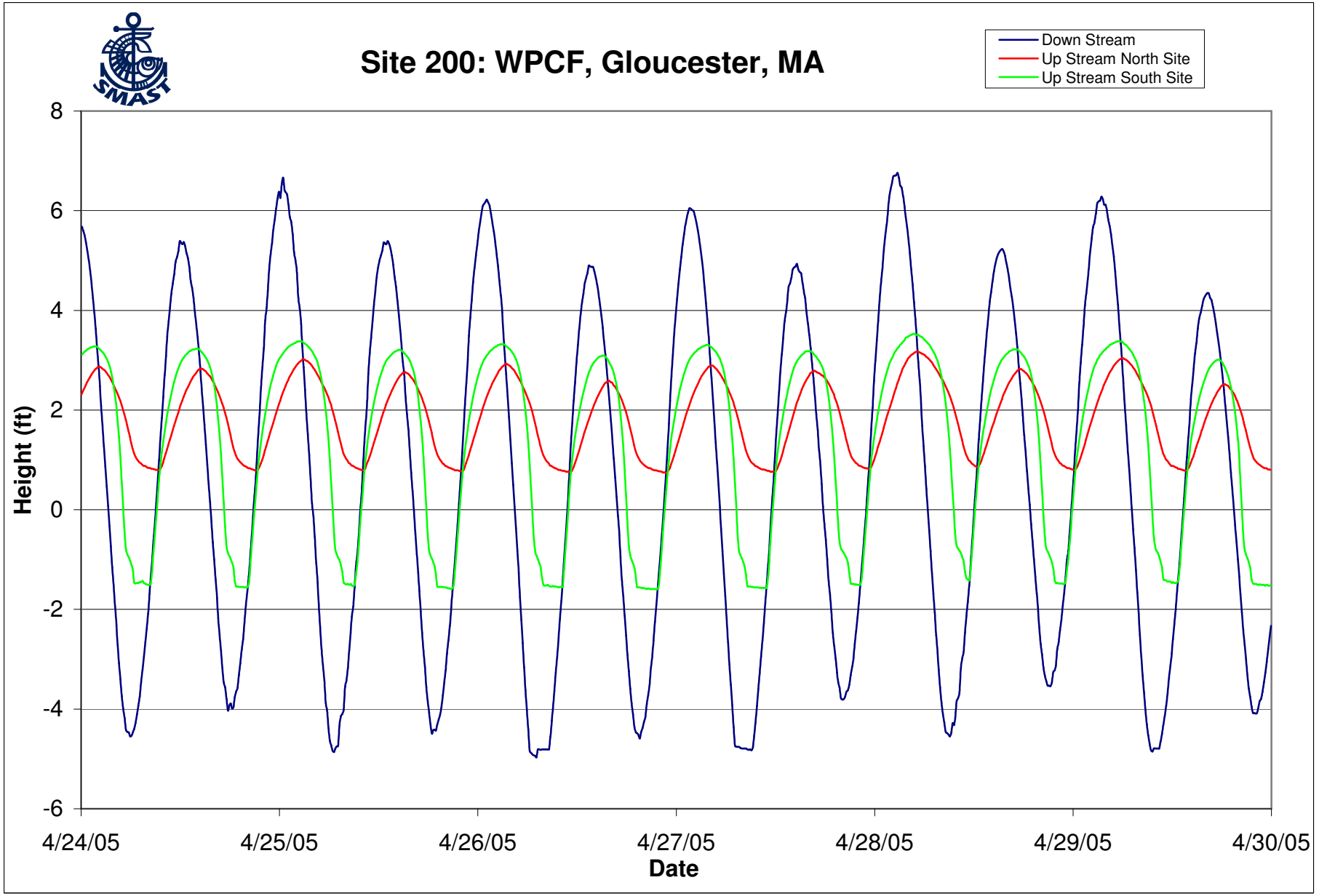
**Photo 6 - Salt Marsh within Southern Site Viewing South**

**Photo 7 - View of Upstream Culvert within Northern Site**

**Photo 8 - Upper Reach of Northern Site**

**Photo 9 - Central Portion of Northern Site**

**Photo 10 - Northern Site Viewing South**


Site 200: WPCF, Gloucester, MA
Down Stream
Up Stream North Site
Up Stream South Site
Height (ft)
8
6
4
2
0
-2
-4
-6
4/24/05
4/25/05
4/26/05
4/27/05
4/28/05
4/29/05
4/30/05
Date

# Great Marsh Coastal Wetlands Restoration Planning

## *Rapid Field Assessment*

*Site # 200*

*Gloucester Water Pollution and Control Facility*

### *Site Information*

| | |
|---|---|
| Site ID: | 200 |
| Site Name: | Gloucester Water Pollution and Control Facility |
| Municipality | Gloucester |
| Location: | Western side of Route 133 (Essex Avenue), 0.25 mi north of Route 127 intersection |
| Adjacent Waterbody: | Annisquam River |

### *Affected Area (Acres)*

| | | | |
|---|---|---|---|
| Mudflat/Open Water: | 0.7 | Total Area: | 20.6 |
| Salt Marsh: | 8.4 | | |
| Other Wetland: | 11.4 | *Other Description:* | |
| Other: | 0.2 | Coastal Bank | |

### *Impairment(s)*

| | | | |
|---|---|---|---|
| Tidal Restriction | ☑ | Fill | ☑ |
| Obstructed Ditche(s) | ☑ | Invasive Species | ☑ |
| Impoundment | ☑ | Pollution / Siltation | ☑ |

Severity of Impairments: Severe

### *Project Type*

| | | | |
|---|---|---|---|
| Roadway Culvert(s) | ☑ | Obstructed Ditches | ☑ |
| Bridge | ☐ | Fill | ☑ |
| Berm | ☐ | Other | |

### *Evidence of Restriction*

| | | | |
|---|---|---|---|
| Gauge Data | ☑ | Impounded Flow | ☑ |
| Downstream Scour Pool | ☑ | Obstructed Flow | ☐ |
| Upstream Scour Pool | ☐ | Invasive Species | ☑ |
| Bank Erosion | ☑ | Ponded Conditions | ☑ |
| Slumping | ☐ | Subsidence | ☑ |

### *Structure / Channel:*

| | |
|---|---|
| Overall Condition: | Fair |
| Life Expectancy (Years): | 15 |
| Road Condition: | Good |
| Structure Type: | Cast Iron/RCP |
| Structure Age (Years) | 25 |
| Structure 1 Width (Feet): | 3 |
| Structure 1 Length (Feet): | 40 |
| Structure 2 Width (Feet): | 3 |
| Structure 2 Length (Feet): | 250 |
| Skew (Degrees): | 0 |
| Cover (Feet): | 9 |
| Scour Protectection: | ☑ |
| Adequately Aligned: | ☐ |
| Headwall Type: | Cut Stone |
| Headwalll Condition: | Good |

### *Ecological Integrity / Habitat Value*

Surrounding Land Use %

| | |
|---|---|
| *Commercial / Industrial* | 40 |
| *Residential* | 45 |
| *Agricultural* | 5 |
| *Undeveloped* | 10 |

| | |
|---|---|
| Severity of Impairment(s) | Severe |
| Invasive Plant Cover: | Medium |
| Extent of Wooded Buffer: | Poor |
| Habitat Connectivity: | Poor |
| NHESP Estimated Habitats of Rare Wildlife: | ☐ |
| NHESP Priority Habitats of Rare Species: | ☐ |
| NHESP BioMap Core Habitat: | ☑ |
| NHESP BioMap Supporting Natural Landscape: | ☐ |
| ACEC: | ☐ |
| Anadromous Fish: | ☐ |
| Shellfishing Suitability: | ☑ |
| Barriers to Fish Passage | Minimal |

# Great Marsh Coastal Wetlands Restoration Planning

## *Rapid Field Assessment*

*Site # 200*

*Gloucester Water Pollution and Control Facility*

### *Construction Logistics / Feasibility*

| | |
|---|---|
| Traffic Volume | High |
| Detour Potential | ☑ |
| Site Access | Good |
| Staging Areas | ☑ |
| Fill Material Concern | Minimal |
| Low Lying Property Concerns | Severe |
| Overhead Utility Constraint | Moderate |

Underground Utilities

| | | | |
|---|---|---|---|
| *Water* | ☑ | *Telephone* | ☐ |
| *Gas* | ☑ | *Sewer* | ☑ |
| *Electric* | ☐ | *Drainage* | ☑ |

| | |
|---|---|
| Permitting Complexity | High |
| Local Support | Yes |
| Feasibility Cost | 40,000 |
| Design Cost | 50,000 |
| Permitting Cost | 30,000 |
| Construction Cost | 650,000 |
| Total Cost | 770,000 |
| Relative Cost/Acre | 37,000 |

### *Socioeconomic*

**Recreation**

| | |
|---|---|
| Public Access: | ☐ |
| Watercraft / Portage: | ☐ |
| Wildlife Viewing: | ☑ |

**Education**

| | |
|---|---|
| Schools Nearby: | ☑ |
| Ongoing Research: | ☐ |
| Education / Outreach Potential: | Medium |
| Saftey Concerns (Access): | Medium |

**Uniqueness / Heritage Value**

| | |
|---|---|
| Rare Species Habitat: | ☐ |
| ACEC: | ☐ |
| Cultural Resource Features | ☐ |
| Urban Viewscape Value: | Medium |
| Urban Habitat Value: | Medium |

### *Tide Surveys*

| | *Start:* | | *Finish:* |
|---|---|---|---|
| **Dates of 1st Survey:** | 4/21/2005 | - | 5/2/2005 |
| Date of Highest Tide: | 4/25/2005 | | |
| Max Measured Tidal Dampening: | 3.64 | | |
| Percent of Tidal Prism: | 33 | | |
| Measured Delay: | 2 hr 38 min | | |

| | *Start:* | | *Finish:* |
|---|---|---|---|
| **Dates of 2nd Survey:** | | - | |
| Date of Highest Tide: | | | |
| Max Measured Tidal Dampening: | | | |
| Percent of Tidal Prism: | | | |
| Measured Delay: | | | |

### *Summary*

| | | | |
|---|---|---|---|
| Uniqueness / Heritage Value: | Low | Ecological Integrity: | Low |
| Recreational Value: | Low | Logistics / Feasibility: | Medium |
| Educational Value: | Medium | | |

***Restoration Potential:*** Moderate